CLAIMS

1. A method of monitoring the condition and/or operation of a furnace comprising the step of measuring sub-surface chromium-depletion from a steel member.

2. A method as claimed in claim 1, wherein the steel member is a pipe within a pyrolysis furnace through which hydrocarbons flow.

3. A method as claimed in claim 1 or 2, further comprising the step of using the measurement of chromium depletion to estimate the state of a surface oxide layer.

4. A method as claimed in any preceding claim, further comprising the step of using the measurement of chromium depletion to determining whether burners in the furnace are operating satisfactorily.

5. A method as claimed in any preceding claim, wherein a magnetic source of known strength is used to create a magnetic field in the surface region of the steel member and an estimate of the thickness of the chromium-depleted zone is determined from the resultant magnetic flux density at the surface of the member.

6. A method of determining the thickness of a chromium-depleted zone of a surface region of a steel member comprising the steps of using a magnetic source of known strength to create a magnetic field in the surface region and then determining an estimate of the thickness of the chromium depleted zone from the resultant magnetic flux density at the surface of the member.

7. A method as claimed in claim 5 or 6, wherein the flux density is measured at a position where the magnetic field lines are generally normal to the surface.

8. A method as claimed in claim 5, 6 or 7, wherein the magnetic field is created in the surface region by a magnet having its axis at between 30 degrees and 60 degrees to the surface of the steel member.

9. A method as claimed in claim 8, wherein the axis of the magnets is at substantially 45 degrees to the surface of the member.

10. A method as claimed in any of claims 5 to 9, wherein the magnetic field is created by a permanent magnet.

11. A method as claimed in any of claims 5 to 10, wherein the magnetic flux density is determined by a Hall-effect probe located proximate the surface of the steel member.

12. A method as claimed in claim 11, wherein a hard non-magnetic pad is provided between the Hall-effect probe and the surface.

13. A method as claimed in claim 11 or 12, wherein the field detection axis of the Hall-effect probe is aligned at substantially 45 degrees to the north-south axis of the source of the magnetic field.

14. A method as claimed in claim 11, 12 or 13 wherein an output signal from the Hall-effect probe is processed in order to provide a direct indication of the thickness of the chromium depleted zone and/or the thickness of an associated oxide layer.

15. A method as claimed in any preceding claim, further comprising the step of determining an estimate of the surface oxide layer thickness.

16. Apparatus for determining the thickness of a chromium depleted zone of a surface region of a steel member, the apparatus comprising a magnetic field source and a means for measuring magnetic flux density, wherein the apparatus is arranged such that when it is placed proximate to a steel member the measuring means determines the magnetic flux density in the surface region of the steel resulting from the magnetic field source.

17. Apparatus as claimed in claim 16, further comprising means to process the output from the measuring means and to display the thickness of the chromium depleted zone and/or the thickness of an associated oxide layer.

18. Apparatus as claimed in claim 16 or 17 arranged to operate in accordance with the method of any of claims 1 to 15.